A multi-agency collaborative study

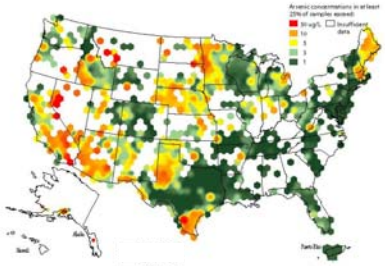
Arsenic in private bedrock wells in southeast New Hampshire

Objectives:

- Conduct a randomly designed study of arsenic occurrence and distribution
- Provide information to the citizens of the region on arsenic occurrence in private wells—37% of drinking water
- Provide a framework to investigate well water arsenic as it relates to geology

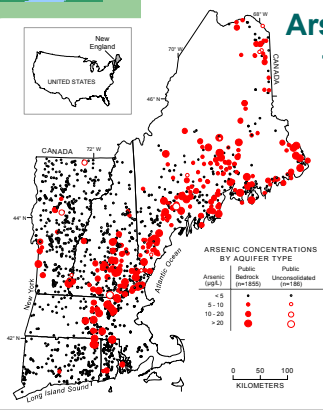
Arsenic in the U.S.

Ryker, 2002



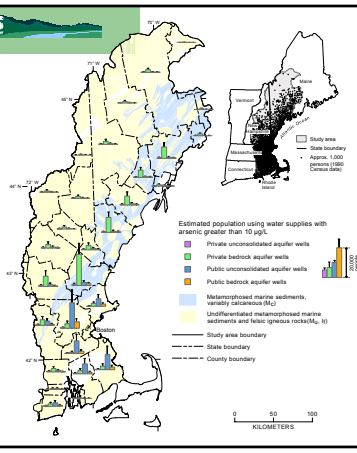
Arsenic in water from selected bedrock wells

(ES&T, 2003)



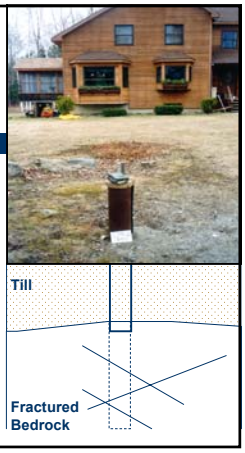
Estimated number of people with arsenic in water supplies

(ES&T, 2003)

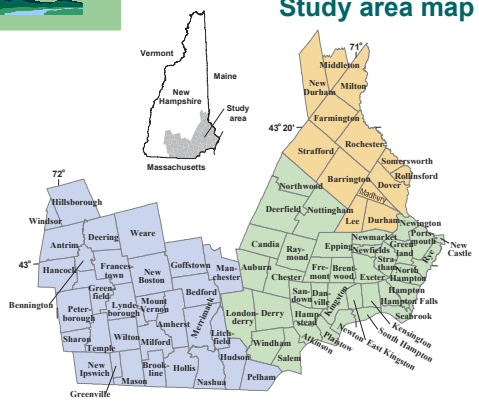


Private bedrock wells

About **40 percent** of drinking water supply for Southeast NH



Study area map



Study design: *Equal-area* grid – spatial random

Methods -- analyze data by county, bedrock formation data

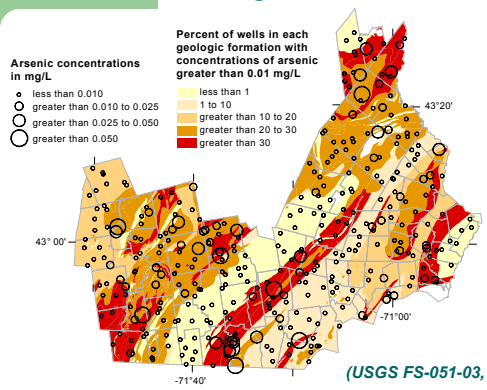
(USGS FS-051-03, 2003)

Results – County summary statistics

County name	No. of wells	Min (µg/L)	Max (µg/L)	Percent of wells with arsenic greater than: (µg/L)		
				5	10	50
Rockingham	125	< 1	215	26	14	2
Strafford	70	< 1	90	37	21	1
Hillsborough	158	< 1	75	32	21	3
Three-county area	353	< 1	215	31	19	2

An estimated 41,000 people in the study area have private water supplies with arsenic above 10 ug/L

Sub-regional scale relations

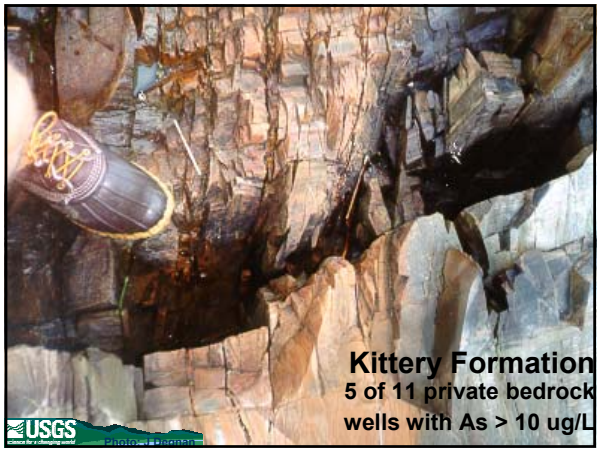


(USGS FS-051-03, 2003)

(USGS FS-051-03, 2003)

Nearly *half* to one-in-three wells with arsenic above 10 µg/L

Bedrock Units	N	Percent of wells with arsenic exceeding 10 µg/L	Percent of southeast New Hampshire
Kittery Fm.	11	**46**	3.4 / 3.4
Rangeley Fm., lower	16	**31**	3.6 / 7.0
Rangeley Fm., upper	16	**31**	5.1 / 12.1
Berwick Fm., unnamed	32	**31**	6.4 / 18.5
Three-county area	353	**19**	100

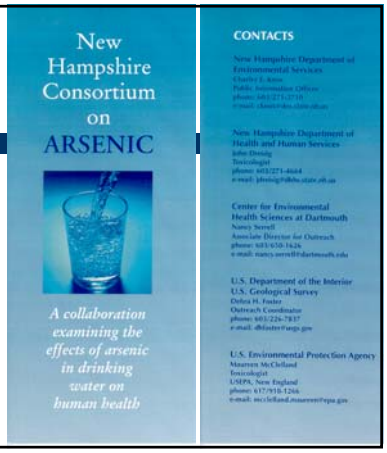


Reporting to homeowners:

Excerpted from results letters…

SITE ID	COLLECTION DATE	YOUR ARSENIC RESULT	NH DRINKING WATER STANDARD	COMPARISON TO DRINKING WATER STANDARD
120.1	7/24/02	215 µg/L	10 µg/L	EXCEEDS

Consortium brochure, mailed with results



Reported water quality *problems* in private wells in southeast NH

Type of water quality problem reported	N	Percent of participants
Iron & Manganese	120	**34**
Sediment	88	**25**
Taste/Odor	43	**12**
pH	6	**2**
Radon	2	**<1**

Reported water *treatment* in private wells in southeast NH

Type of water treatment	N	Percent of participants
Sediment	63	**18**
Ion Exchange	46	**13**
Oxidizing	11	**3**
Reverse Osmosis	5	**1**
Combination	18	**5**

Survey findings:

- Over 90 % of participants use their well water for drinking water
- Fewer than 13 % of participants report testing for arsenic
- Fewer than than 1% have treatment systems specifically designed to remove arsenic

USGS Fact Sheet 051-03
Montgomery et al, 2003

Final report recently released…

ARSENIC CONCENTRATIONS IN PRIVATE BEDROCK WELLS IN SOUTHEASTERN NEW HAMPSHIRE

MAJOR FINDINGS:

INTRODUCTION

Summary:

- Hillsborough and Strafford Counties have more arsenic than previously thought: 1-in-5 wells have arsenic above 10 ug/L
- Fewer than 13% had tested for arsenic; less than 1% have arsenic removal systems
- Related to geology – some parts of towns may be high whereas other parts may be low
- Estimated 41,000 people with private supplies above 10 ug/L

Next steps…

- Determine occurrence and distribution of arsenic in adjacent counties
- Examine temporal variability of arsenic in ground water used for drinking water
- Design investigations to define processes controlling arsenic mobility in localized high-arsenic areas